

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
14 October 2004 (14.10.2004)

PCT

(10) International Publication Number
WO 2004/088147 A1

(51) International Patent Classification⁷: **F15B 15/24**

(21) International Application Number:
PCT/KR2004/000780

(22) International Filing Date: 3 April 2004 (03.04.2004)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
10-2003-0021011 3 April 2003 (03.04.2003) KR

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG,
MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH,
PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

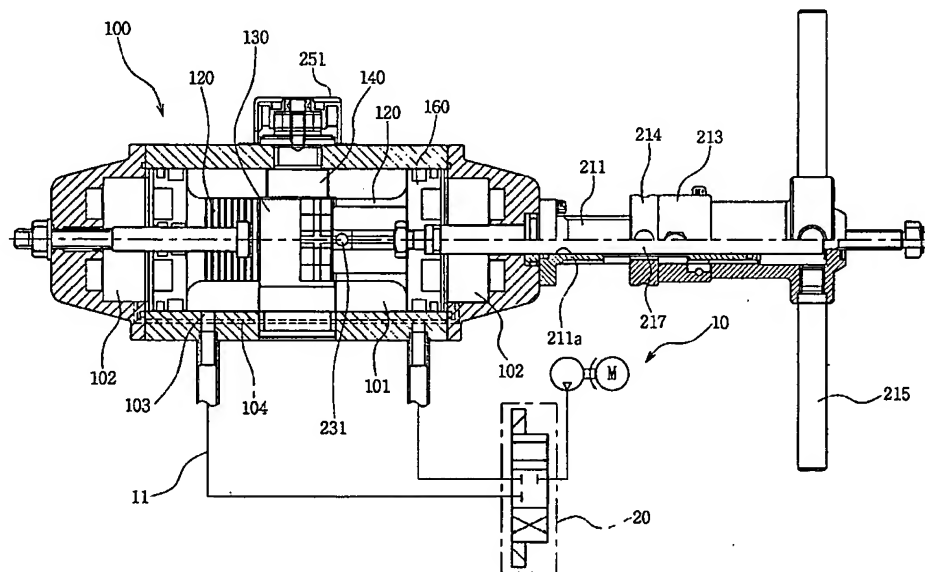
(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), Euro-
pean (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR,
GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: ACTUATOR HAVING THE FUNCTION OF CONTROL OF OPERATION DISPLACEMENT



(57) Abstract: This invention is an actuator having the function of control operation displacement. The invention comprises of cylinder (100), pistons (160), a rotating axis (140) rotatably mounted through the wall of the cylinder (100), a power transmission unit (120, 130) connected between the piston (160) and the rotating axis (140), the flow pathways (11, 12) connecting the first and the second space (101, 102) to the exterior solenoid valve (20), a magnet (231) provided on one side of the piston (160), a guide (211) provided on one side of the cylinder (100), a slider (213) being guided by the guide (211) and moving reciprocally along the piston (160), a magnet sensor (235) adjacent to the wall of the cylinder.

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JG20 Rec'd PCT/MO 15 SEP 2005

ACTUATOR HAVING THE FUNCTION OF COTRNOL OF OPERATION
DISPLACEMENT

FIELD OF THE INVENTION

5 This invention relates to an actuator having the function of control of operation displacement, and more particularly to an actuator in which the angle range of the rotating axis could be easily adjusted by means of simple magnetic sensor without complicated control device.

10

BACKGROUND OF THE INVENTION

 Generally, the actuator is a device which is coupled to a desired unit and provides a driving unit with a forward or backward force and/or a rotating force generated by the hydraulic
15 or pneumatic source. The actuator according to the present invention may be applied to both hydraulic and pneumatic actuators, but for convenience, all description and explanation will be given for the pneumatic actuator, hereinafter.

 Fig. 1 depicts an example of actuator according to the prior
20 art, in which a pneumatic actuator for operating a swivel valve is shown. As seen from the drawing, the actuator comprises a pair of piston 160 positioned at both side of interior of cylinder 100; a rotating axis 140 rotating in either direction by the forward or backward action of piston 160; the first air pathway
25 103 connecting the space 101 between the pistons 160 to the exterior of cylinder; and the second air pathway 104 connecting

the space 102 between the pistons 160 and the corresponding cylinder end wall to the exterior of cylinder, thereby opening and shutting the valve connected to the rotating axis 140 by each forward or backward action of the opposed pistons 160 by means of the direction of the compressed air provided through the first and second air pathways 103,104.

In this actuator, if any external device is coupled with the rotating axis 140, an additional control unit is necessarily required to adjust an action range of the external device such as the angle of valve opening. This control unit comprises of a sensor to detect the displacement of the rotating axis 40, and a controller to control the action of the solenoid valve 20 according to the input data from the sensor and input means to set the action range of the device. And the cost of all these components is expensive, which results in high cost in installing the actuator.

SUMMARY OF THE INVENTION

The invention is provided to solve the problems as described above and the object of the invention is to suggest a novel actuator having the function of control of operation displacement in which the angle range of the rotating axis could be easily adjusted by means of simple magnetic sensor without additional complicated control device so as to achieve a cost down.

According to one aspect of the invention, there is provided an actuator having the function of control of operation displacement, which comprises of cylinder 100 in which a working flow is supplied, one or more piston 160 reciprocally movable
5 in the cylinder 100 to divide the inner space of cylinder 100 into the first space 101 and the second space 102, a rotating axis 140 rotatably mounted through the wall of the cylinder 100, a power transmission unit 120,130 connected between the piston 160 and the rotating axis 140 to transfer the reciprocating force
10 of piston 160 to the rotating axis 140 and the flow pathways 11,12 connecting the first and the second space 101,102 to the exterior solenoid valve 20, and the rotating axis 140 could be rotated according to the action of solenoid valve 20, characterized in that the actuator further comprises of a magnet
15 231 provided on one side of the piston 160, a guide 211 provided on one side of the cylinder 100 in the reciprocal direction of the piston 160, a slider 213 being guided by the guide 211 and moving reciprocally along the piston 160, a working rod 233 extending from one side of the slider 213 toward the center of
20 the cylinder 100, a magnetic sensor 235 provided on the working rod 233 and being adjacent to the wall of the cylinder 100, the magnetic sensor 235 being capable of sending a signal to the solenoid valve 20 if the magnet 231 is sensed, and a action range setting means 219,221 having the scale representing displacement
25 of the magnetic sensor 235.

According to another aspect of the invention, there is provided an actuator having the function of control of operation displacement, wherein a slide hole 211a is formed in the longitudinal direction on the center of the guide 211, and a
5 reciprocating rod 217 is inserted on the slide hole 211a to move the piston 160 reciprocally.

According to another aspect of the invention, there is provided an actuator having the function of control of operation
10 displacement, which comprises of cylinder 100 in which a working flow is supplied, one or more piston 160 reciprocally movable in the cylinder 100 to divide the inner space of cylinder 100 into the first space 101 and the second space 102, a rotating axis 140 rotatably mounted through the wall of the cylinder 100,
15 a power transmission unit 120,130 connected between the piston 160 and the rotating axis 140 to transfer the reciprocating force of piston 160 to the rotating axis 140 and the flow pathways 11,12 connecting the first and the second space 101,102 to the exterior solenoid valve 20, and the rotating axis 140 could be
20 rotated according to the action of solenoid valve 20, characterized in that the actuator further comprises of a magnet 231 provided on one side of the piston 160, a guide 211 provided on one side of the cylinder 100 vertically to reciprocal direction of the piston 160, a slider 213 being guided by the guide 211
25 and moving vertically to the reciprocal direction of the piston 160, a sliding plate 241 provided outside of the cylinder 100

and being movable along the reciprocating piston 160 and having an inclined slot 243 by which the guide 211 is engaged, a magnetic sensor 235 provided on one side of the sliding plate 241 and being adjacent to the wall of the cylinder 100, the magnetic sensor 235 being capable of sending a signal to the solenoid valve 20 if the magnet 231 is sensed, and an action range setting means 219, 221 having the scale representing displacement of the magnetic sensor 235, and sliding plate 241 is slid along the reciprocal direction of the piston 160 as the slider 213 moves vertically.

According to another aspect of the invention, there is provided an actuator having the function of control of operation displacement, wherein a slide hole 211a is formed in the longitudinal direction on the center of the guide 211, and a reciprocating rod 217 is inserted on the slide hole 211a to move the piston 160 reciprocally.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a section of the conventional actuator
Figure 2A to 2C are front view, plan view and side view of the embodiment of the invention respectively
Figure 3 is a section of Figure 2A
Figure 4 is another embodiment of the invention
Figure 5 is a section of Figure 4
Figure 6 is another embodiment of the invention

Figure 6 is another embodiment of the invention

BEST MODE FOR CARRING OUT THE INVENTION

Preferred embodiments of the invention will be described
5 in detail below by referring to the accompanying drawings.

Figures 2A to 2C are front view, plan view and side view
respectively of the embodiment of the invention and Figure 3
is a section of Figure 2A.

As shown in the drawings, the actuator comprises of
10 cylinder 100 in which working flow is supplied, a pair of piston
160 reciprocally movable in the cylinder 100, a power
transmission unit having racks 120 mounting on the piston 160
and reciprocate to each other and a pinion 130 being engaged
with the racks 120 and mounted rotatably in the cylinder 100.
15 A rotating axis 140 is mounted on the wall of cylinder 100 to
be the center of the pinion 130.

And a magnet 231 is mounted on the side of the piston 160.
An axial guide 211 is provided on the longitudinal end of the
cylinder 100 along the reciprocal direction of the piston 160.
20 And a slider 213 is threaded on the guide 211 and rotated to
slide along the reciprocal direction of the piston. A working
rod 233 is attached on one side of the slider 213 and extending
toward the center of the cylinder 100. And a magnetic sensor
235 is provided on the working rod 233 and is adjacent to the
25 wall of cylinder 100. And an action range setting means 219, 221
is provided on the working rod 233 to represent the displacement

of the magnetic sensor 235. And the cylinder 100 is provided with the flow pathways 11,12 connecting the air compressor 10 and a solenoid valve 20 is connected on these flow pathway 11,12.

The inner space of the cylinder 100 is partitioned by
5 pistons 160 into the first space 101 between the pistons 160 and the second space 102 outside the piston 160. And on the wall of the cylinder 100 is formed the first flow pathway 103 connecting the first space 101 to the flow pathway 11 and the second flow pathway 104 connecting the second space 102 to the flow pathway
10 12. And the two flow pathways 11,12 are connected to the solenoid valve 20. Accordingly, the compressed air from the air compressor 10 could be selectively supplied to the first space 101 or the second space 102 by manipulating the solenoid valve 20.

The slider 213 is rotated to move the magnetic sensor 235
15 to a predetermined position and has a handle 215 on its end. On one side of the slider 213 is provided a clamp nut 214 so that the slider 213 is clamped on the guide 211 at a predetermined position. A slide hole 211a is formed in the longitudinal direction on the center of the guide 211 and a reciprocating
20 rod 217 is inserted on the slide hole 211a to reciprocate the piston 160 manually.

The magnetic sensor 235 is to detect that the piston 160 has arrived to a set position and it is moved by the slider 213 to a predetermined position. If the piston 160 comes near and
25 the magnet 231 is detected by the magnetic sensor 235, it will send a signal to a solenoid valve 20 and the solenoid valve will

shut or open the flow pathway in a predetermined way.

The action range setting means 219, 221 sets the action range of the rotating axis 140 and is comprised of scale 221 installed on the cylinder 100 adjacent to slider 213 to represent
5 the rotated angle of the rotating axis 221 and the needle 219 attached on the slider 213. And, an indicator 251 is provided on the cylinder 100 to show the actual rotated angle of the rotating axis 140.

The function of the invention will be described below.
10 The user may turn the handle 215 to locate the magnetic sensor 235 connected on the slider 213 to a predetermined position. At this time, the user may watch the needle 219 pointing the scale 221 and moving the slider 213. And if it arrives at a set position, the clamp nut 214 should be clamped to stop the slider
15 213.

And power will be applied to solenoid valve 20, and the compressed air will selectively supplied to the first space 101 or the second space 102 of the cylinder 100 according to the set of the solenoid 20. Accordingly, the piston 160 will move
20 the racks 120 reciprocally and the pinion 130 will be rotated to drive the external device through the rotating axis 140.

If the magnet 231 is detected by the magnetic sensor 235 while the pistons reciprocate, the solenoid valve 20 will shut the air to the cylinder 100, and the rotating axis 140 may be
25 stop. And if the external device coupled to rotating axis 140 is a valve, the rotated angle of the valve can be adjusted. As

a result, the invention could achieve an actuator with adjustable action range with a simple structure and low cost.

Figure 4 and 5 shows another embodiment of the invention. This embodiment is same as the above embodiment except that the
5 slider 213 is moving vertically to the reciprocating direction of piston 160. That is, the guide 211 is installed on one side of the cylinder 100 vertically to the reciprocating direction of the piston 160, and the slider 213 mounted on the guide 211 is also moving vertically. A sliding plate 241 is installed on
10 the surface of the cylinder 100 movably along the reciprocating direction of piston 160, and an inclined slot 243 is formed on the slide plate 241. A pin mounted on the slider 213 is engaged with the slot 243 so that as the slider 213 moves vertically to the reciprocating direction of the piston 160, the slide plate
15 241 will be moved along the reciprocating direction of the piston 160.

And a magnetic sensor 235 is installed on the sliding plate 241 adjacent to the cylinder 100, and a scale 221 is installed on the cylinder 100 near the sliding plate 241 and the needle
20 219 is attached on the sliding plate 241. And a slide hole 211a is formed in the longitudinal direction of the guide 211, and a reciprocating rod 217 is inserted in the slide hole 211a. The user may manipulate this rod 217 to move the piston 160 and the rotating axis 140. This embodiment may be advantageous in saving
25 the occupying space depending on the field condition because the length of the apparatus may be shortened.

In the above preferred embodiment, the racks 120 and the pinion 130 is described as a power transmission unit, but other ordinary mechanism may be employed to convert the reciprocating force to rotating force. Such example is depicted in Figure 6, in which a rotary member 130 is coupled to the rotating axis 130, and the links 120 are connected between the piston 160 and the rotary member 130.

And in the above embodiment, it is described that the cylinder 100 has two pistons 160 and the inner space is divided into two spaces. But, it is only exemplary and various formations will be possible about the shape and type of the cylinder 100.

INDUSTRIAL APPLICABILITY

According to the invention as described above, if the piston 160 is moved so much as the set displacement by sliding the slider 213, the magnetic sensor 235 will detect and send a signal to the solenoid valve 20 then the solenoid valve 20 will shut off the working flow, therefore the action range of the external unit coupled to the rotating axis 140 may be effectively adjusted without any complicated and high cost controller devices.

Fig. 1

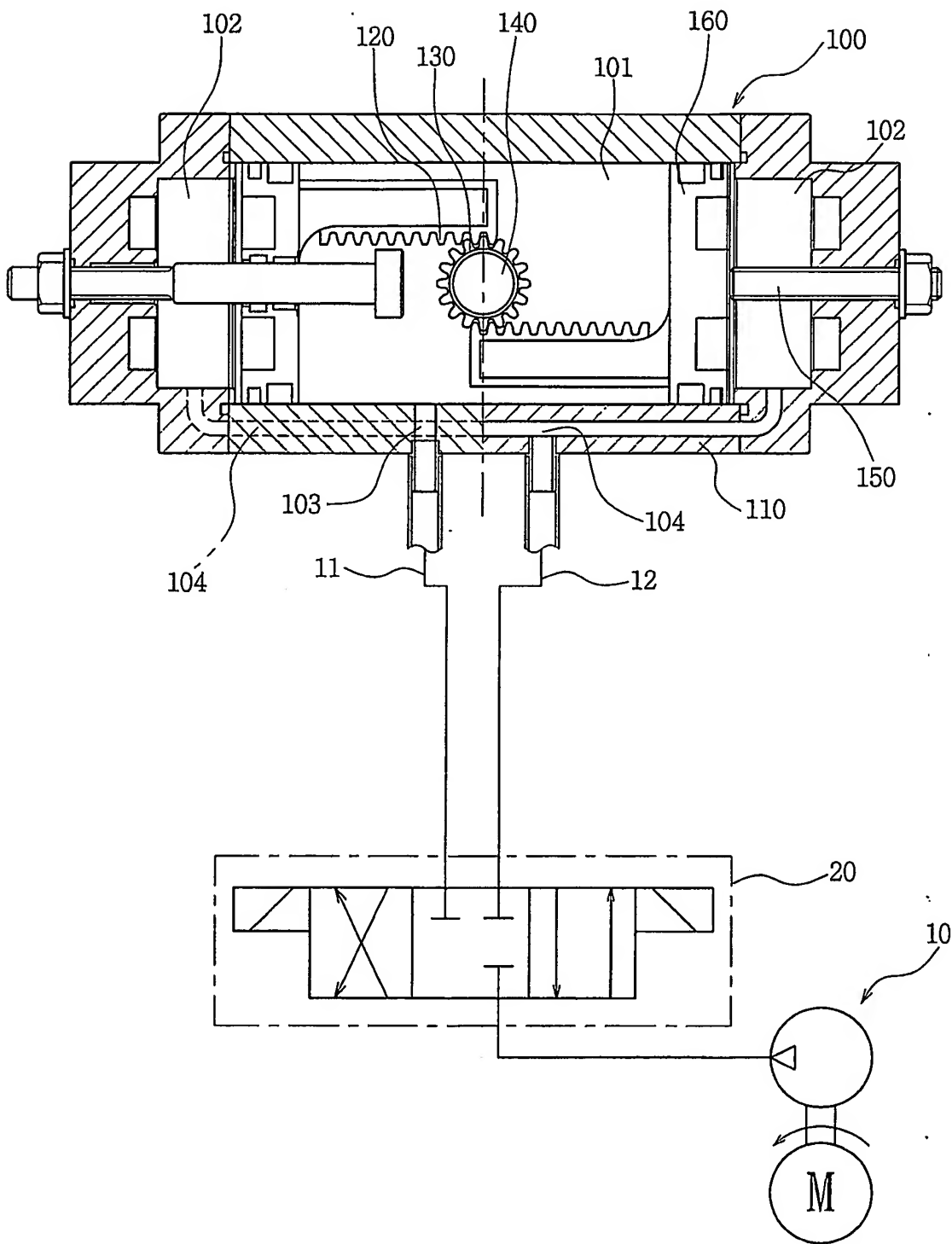
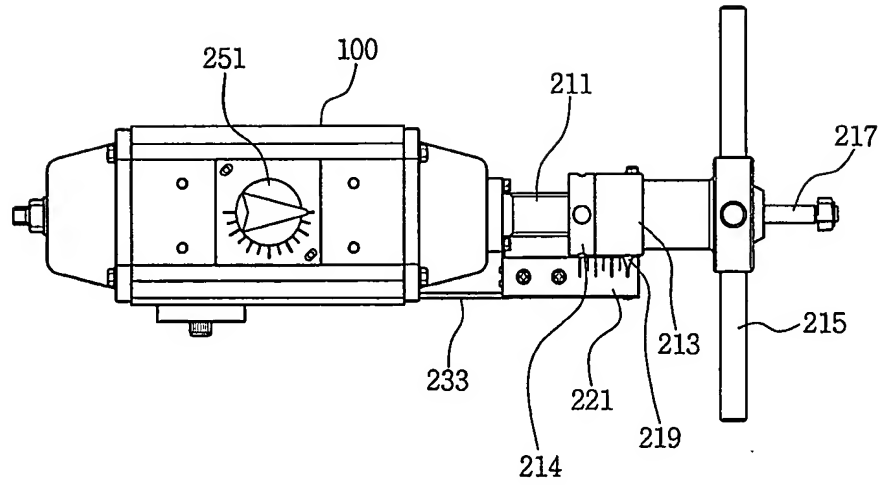
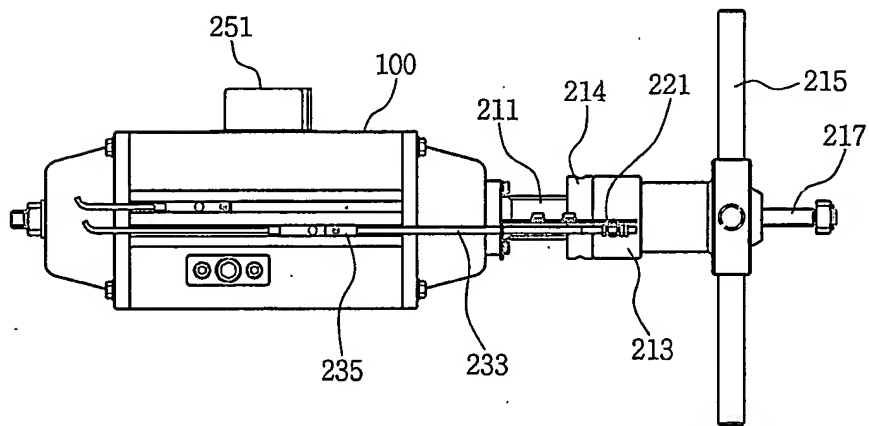


Fig. 2

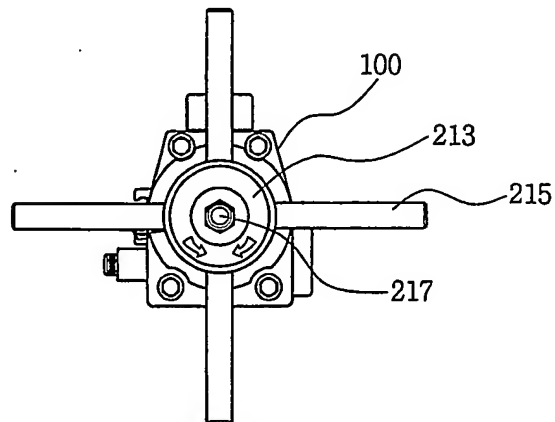
A



B



C



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Fig. 3

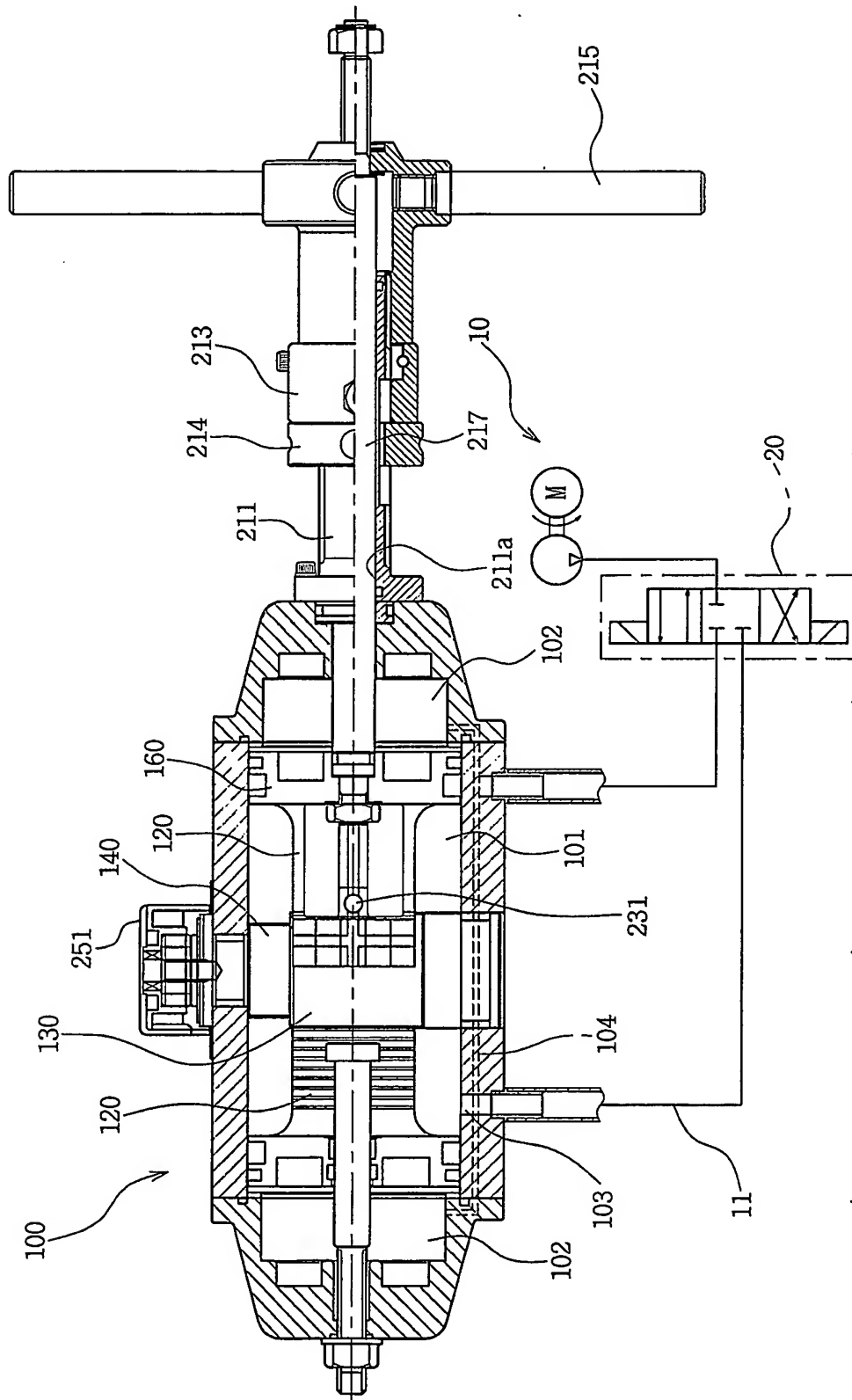


Fig. 4

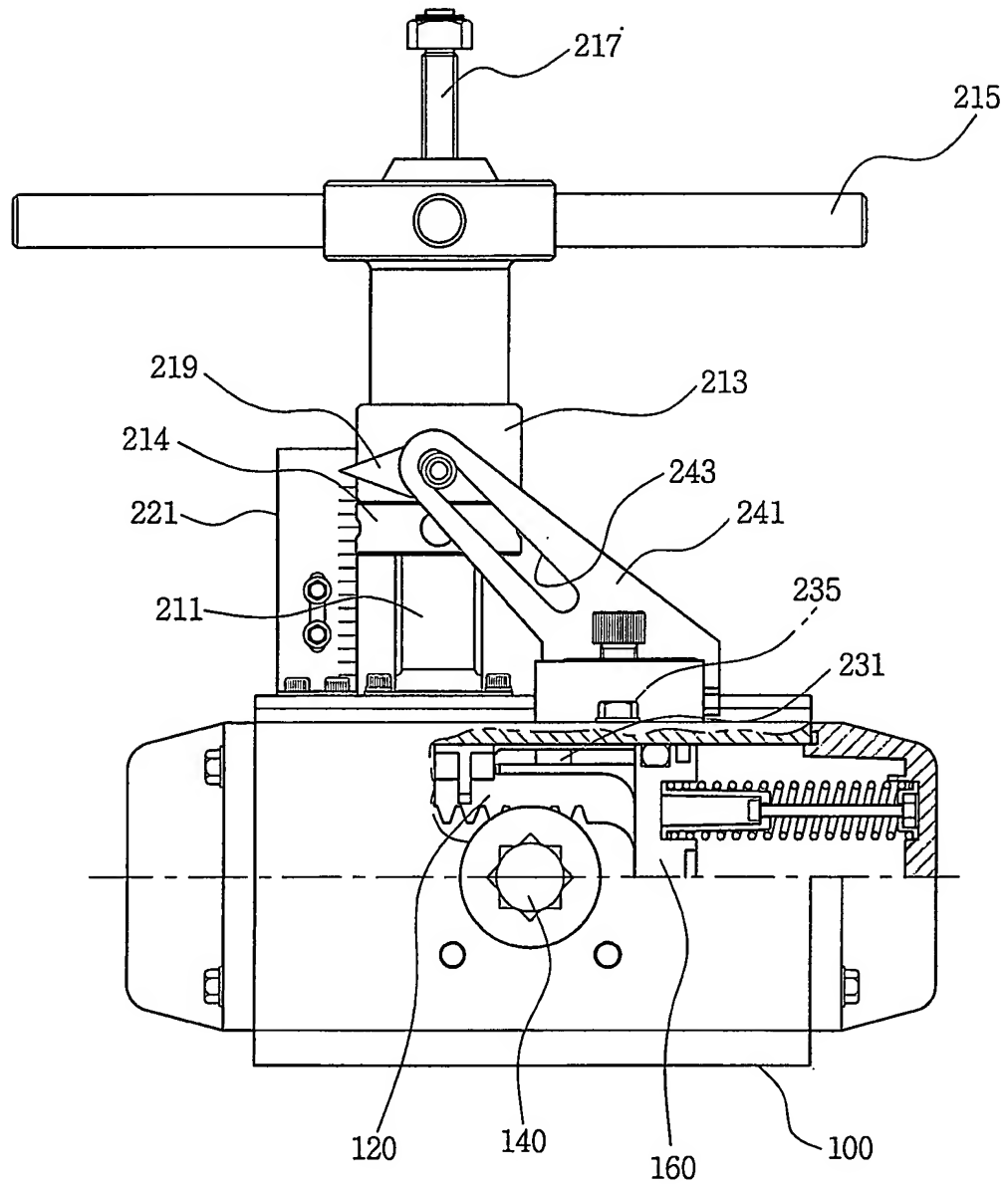
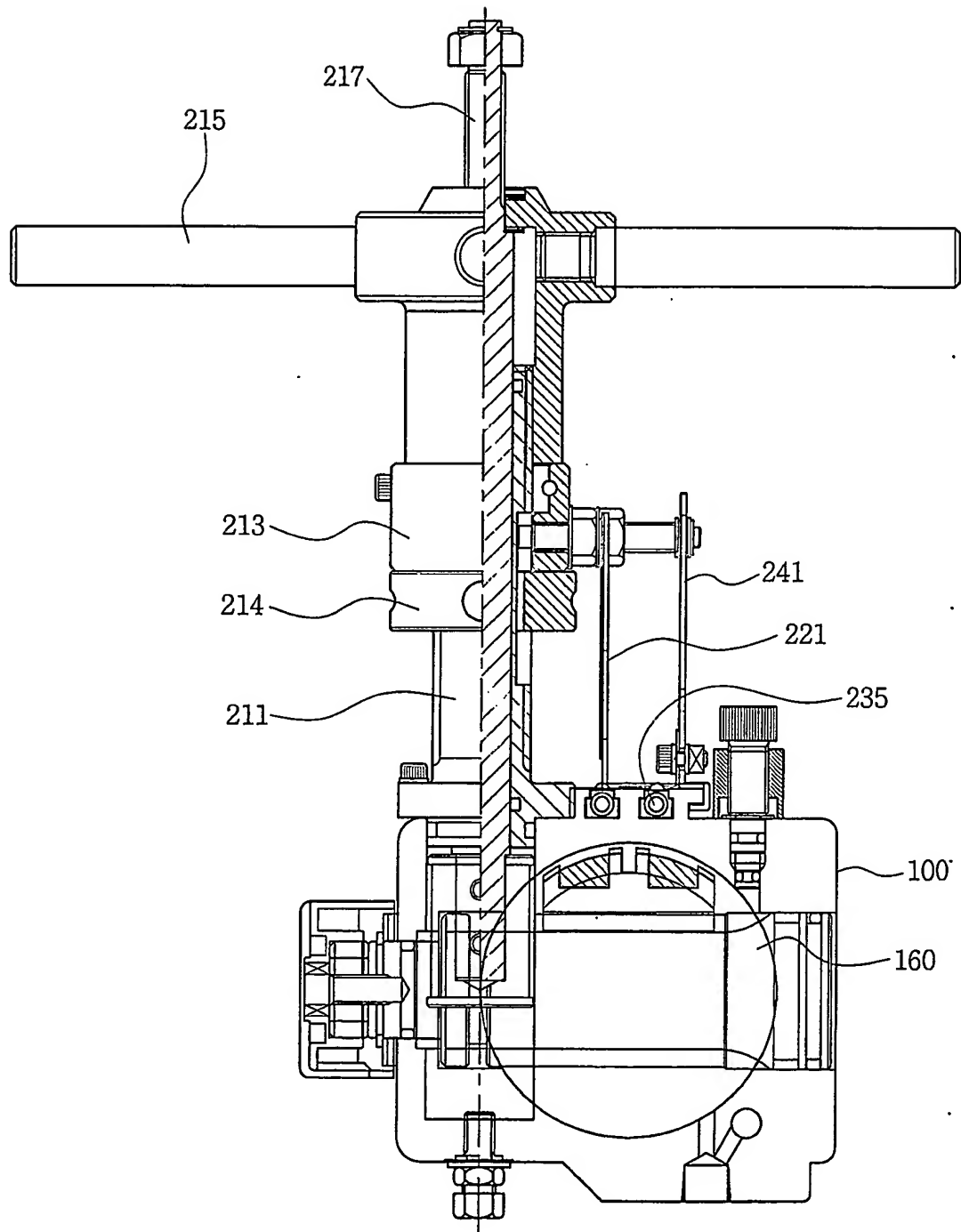
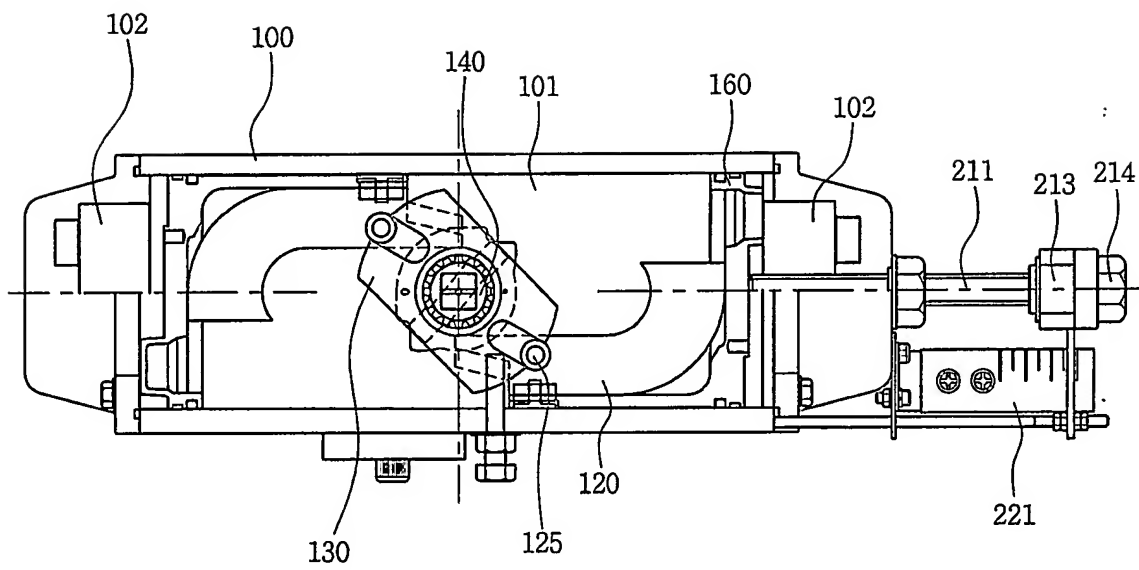


Fig. 5



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Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2004/000780

A. CLASSIFICATION OF SUBJECT MATTER**IPC7 F15B 15/24**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 F15B, C, D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 04-34203A (T V VALVE KK) 05.02.1992, SEE THE ABSTRACT & FIG15	1 ~ 4
A	JP 51-69768 A (AVE MACHINE KK) 16.06.1976, SEE THE ABSTRACT & FIG1 ~ FIG2	1 ~ 4
A	DE3329171A1 (SAMSON AG) 28.02.1985, SEE THE ABSTRACT & FIG	1 ~ 4
A	US 2002017190AA (SMC KK) 14.02.2002, SEE THE ABSTRACT & FIG1 ~ FIG3	1 ~ 4

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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"E" earlier application or patent but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search

15 JULY 2004 (15.07.2004)

Date of mailing of the international search report

15 JULY 2004 (15.07.2004)

Name and mailing address of the ISA/KR

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Republic of Korea

Facsimile No. 82-42-472-7140

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Telephone No. 82-42-481-5458



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2004/000780

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 04-34203A	05.02.1992	NONE	
JP 51-69768A	16.06.1976	NONE	
DE 3329171A1	28.02.1985	NONE	
US 2002017190AA	14.02.2002	US 6571681BB	03.06.2003
		DE 10137468A1	21.02.2002
		JP 2002048108A2	15.02.2002
		SE 200102647A	05.02.2002
		TW 503411B	23.07.2001
		CN 1337723A	27.02.2002

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CLAIMS

1. An actuator having the function of control of operation displacement, which comprises of cylinder 100 in which a working flow is supplied, one or more piston 160 reciprocally movable
5 in the cylinder 100 to divide the inner space of cylinder 100 into the first space 101 and the second space 102, a rotating axis 140 rotatably mounted through the wall of the cylinder 100, a power transmission unit 120,130 connected between the piston 160 and the rotating axis 140 to transfer the reciprocating force
10 of piston 160 to the rotating axis 140 and the flow pathways 11,12 connecting the first and the second space 101,102 to the exterior solenoid valve 20, and the rotating axis 140 could be rotated according to the action of solenoid valve 20, characterized in that the actuator further comprises of a magnet
15 231 provided on one side of the piston 160, a guide 211 provided on one side of the cylinder 100 in the reciprocal direction of the piston 160, a slider 213 being guided by the guide 211 and moving reciprocally along the piston 160, a working rod 233 extending from one side of the slider 213 toward the center of
20 the cylinder 100, a magnetic sensor 235 provided on the working rod 233 and being adjacent to the wall of the cylinder 100, the magnetic sensor 235 being capable of sending a signal to the solenoid valve 20 if the magnet 231 is sensed, and a action range setting means 219;221 having the scale representing displacement
25 of the magnetic sensor 235.

2. An actuator of claim 1, wherein a slide hole 211a is formed in the longitudinal direction on the center of the guide 211, and a reciprocating rod 217 is inserted on the slide hole 211a to move the piston 160 reciprocally.

5

3. An actuator having the function of control of operation displacement, which comprises of cylinder 100 in which a working flow is supplied, one or more piston 160 reciprocally movable in the cylinder 100 to divide the inner space of cylinder 100 into the first space 101 and the second space 102, a rotating axis 140 rotatably mounted through the wall of the cylinder 100, a power transmission unit 120,130 connected between the piston 160 and the rotating axis 140 to transfer the reciprocating force of piston 160 to the rotating axis 140 and the flow pathways 11,12 connecting the first and the second space 101,102 to the exterior solenoid valve 20, and the rotating axis 140 could be rotated according to the action of solenoid valve 20, characterized in that the actuator further comprises of a magnet 231 provided on one side of the piston 160, a guide 211 provided on one side of the cylinder 100 vertically to reciprocal direction of the piston 160, a slider 213 being guided by the guide 211 and moving vertically to the reciprocal direction of the piston 160, a sliding plate 241 provided outside of the cylinder 100 and being movable along the reciprocating piston 160 and having an inclined slot 243 by which the guide 211 is engaged, a magnetic sensor 235 provided on one side of the sliding plate 241 and

being adjacent to the wall of the cylinder 100, the magnetic sensor 235 being capable of sending a signal to the solenoid valve 20 if the magnet 231 is sensed, and a action range setting means 219, 221 having the scale representing displacement of the magnetic sensor 235, and sliding plate 241 is slid along the reciprocal direction of the piston 160 as the slider 213 moves vertically.

4. An actuator of claim 3 a slide hole 211a is formed in the longitudinal direction on the center of the guide 211, and a reciprocating rod 217 is inserted on the slide hole 211a to move the piston 160 reciprocally.